CRYPTOSPORIDIOSIS

Potential Bioterrorism Agent: Category B

Responsibilities:
Hospital: Report by IDSS, facsimile, mail or phone
Laboratory: Report by IDSS, facsimile, mail or phone
Physician: Report by facsimile, mail or phone
Local Public Health Agency (LPHA): Follow-up Required

Iowa Department of Public Health
Disease Reporting Hotline: (800) 362-2736
Secure Fax: (515) 281-5698

1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Agent

Cryptosporidiosis refers to disease caused by *Cryptosporidium,* a coccidian protozoan. Many species of *Cryptosporidium* exist that infect humans and a wide range of animals. *Cryptosporidium parvum* and *Cryptosporidium hominis*, are the most prevalent species causing disease in humans, infections by *C. felis*, *C. meleagridis*, *C. canis*, and *C. muris* have also been reported. *Cryptosporidium* was not recognized as a cause of human illness until 1976.

B. Clinical Description

Symptoms: The most common symptom of cryptosporidiosis is profuse and watery diarrhea, which may be preceded by anorexia and vomiting in children. The diarrhea is associated with cramping abdominal pain. Other signs and symptoms include weight loss, stomach cramps, nausea, vomiting, and low-grade fever. Some people with cryptosporidiosis will have no symptoms at all. While the small intestine is the site most commonly affected, *Cryptosporidium* infections could possibly affect other areas of the digestive or respiratory tract. Asymptomatic infections are common and often serve as a source of infection for others.

Complications: Symptoms often wax and wane, but improve in fewer than 30 days in most immunocompetent people (average is 10 days). Immunodeficiency, especially in HIV infection, is associated with an inability to clear the parasite, and the disease may have a prolonged and fulminant clinical course, leading to death.

Treatment: FDA licensed nitazoxanide (Alinia®) for the treatment of diarrhea caused by *Cryptosporidium* in immunocompetent individuals >1 years of age.

C. Reservoirs

Common reservoirs: The reservoirs for the *Cryptosporidium species* that infect humans are humans, cattle, and other domesticated animals, including pets.

D. Modes of Transmission:

Spread: Transmission is fecal-oral, which includes person-to-person, animal-to-person, waterborne and foodborne.

Survivability: The oocyst of the parasite can survive in feces for a prolonged length of time and is resistant to chlorination.

Person-to-person: Many persons are infected by hand-to-mouth transfer of oocysts from the feces of an infected person, especially in institutions and child care centers. Transmission can also occur person-to-person through sexual contact, particularly oral-anal contact. Infected animals and people excrete large numbers of oocysts in stool and, although the infectious dose is not certain, it is probably very low.

Waterborne/Foodborne: Oocysts are relatively hardy and can survive in the environment for weeks or months. They are resistant to concentrations of chlorine and other disinfectants commonly used for drinking water or swimming pool treatment. Large outbreaks traced to contaminated drinking water have been reported, including an outbreak in Milwaukee that reportedly affected 400,000 people. Localized outbreaks may occur from fecally contaminated water, such as streams/lakes and swimming pools open to contamination by human and animal feces. Outbreaks have resulted from eating food contaminated by animal feces (*e.g.,* unpasteurized apple cider). An infected food worker could be a source of foodborne transmission. There have also been outbreaks associated with "recreational water", meaning water used for swimming such as municipal swimming pools, lakes, etc.

Zoonotic: Transmission can occur through contact with feces from infected animals (a risk for livestock handlers, dairy farmers and veterinarians). People are not infected through contact with blood.

E. Incubation period

The incubation period is not precisely known; 1 - 12 days is the likely range, with an average of about 7 days.

F. Period of Communicability or Infectious Period

The disease is communicable for as long as the infected person excretes *Cryptosporidium* oocysts. Excretion generally begins at the onset of symptoms. Oocysts continue to be excreted in the stool for several weeks after symptoms subside, and they may remain infective outside the body for 2 - 6 months in a moist environment.

G. Epidemiology

Cryptosporidiosis has a worldwide distribution. Cases occur year-round with a peak during summer and early fall. Prior to 2006, approximately 70 cases were reported each year in Iowa. In recent years the number of cases reported in Iowa has dramatically increased with 364 cases in 2011, 328 cases reported in 2012 and 1505 cases in 2013. In developed countries, the prevalence of infection ranges from < 1% to 4.5% of individuals surveyed by stool examination. The prevalence is significantly higher in developing regions of the world. Cryptosporidiosis is among the most common causes of persistent diarrhea in patients with AIDS in the United States. Children under two years of age, animal handlers, travelers to endemic areas, men who have sex with men, and close contacts of infected individuals are most likely to be infected. Outbreaks have been reported in child care centers and have been associated with public drinking water; swimming in contaminated pools, lakes and ponds; and drinking unpasteurized cider made from apples contaminated with cattle manure. It is estimated that 50% of dairy calves shed oocysts and that the parasite is present on >90% of dairy farms.

H. Bioterrorism Potential

Category B Agent: *Cryptosporidium parvum* is identified as a Category B bioterrorism agent, seen particularly as a water safety threat by the CDC. If acquired and properly disseminated, *Cryptosporidium parvum* could cause a serious public health challenge because the protozoans are

moderately easy to disseminate, result in moderate morbidity rates and low mortality rates, and require specific enhancements of CDC's diagnostic capacity and enhanced disease surveillance.

2) DISEASE REPORTING AND CASE INVESTIGATION

A. Purpose of Surveillance and Reporting

- To identify whether the case may be a source of infection for other persons (*e.g.,* a diapered child, child care attendee, or food handler) and, if so, prevent further transmission.
- To identify transmission sources of public health concern (*e.g.,* a contaminated public water supply) and stop transmission from the source.

B. Laboratory and Healthcare Provider Reporting Requirements

Iowa Administrative Code 641-1.3(139) stipulates that the laboratory and the healthcare provider must report. The preferred method of reporting is by utilizing the Iowa Disease Surveillance System (IDSS). However, if IDSS is not available to your facility the reporting number for IDPH Center for Acute Disease Epidemiology (CADE) is (800) 362-2736; fax number (515), 281-5698, mailing address:

IDPH, CADE
Lucas State Office Building, 5th Floor
321 E. 12th St.
Des Moines, IA 50319-0075

Postage-paid disease reporting forms are available free of charge from the IDPH clearinghouse. Call (319) 398-5133 or visit the website: healthclrhouse.drugfreeinfo.org/cart.php?target=category&category_id=295 to request a supply.

Laboratory Testing Services Available

The University of Iowa State Hygienic Laboratory (SHL) tests stool specimens for *Cryptosporidium*. Submit specimens in SHL's ova and parasite kit. Specimen collection kits are available from SHL. Contact SHL at (319) 335-4500 or visit the web site www.shl.uiowa.edu/kitsquotesforms/ for further instructions.

C. Local Public Health Agency Follow-up Responsibilities

Case Investigation

a. It is the LPHA's responsibility to complete a *Cryptosporidiosis* case investigation in the Iowa Disease Surveillance System (IDSS) by interviewing the case and others who may be able to provide pertinent information. Much of this information can be obtained from the case's health care provider or the medical record.
b. Use the following guidelines in completing the investigation:
    1. Record the demographic information, event information, laboratory findings, date of symptom onset, symptoms, treatment, and other clinical information.
    2. When asking about exposure history (food, travel, activities, etc.), use the incubation-period for cryptosporidiosis (1-12 days).
    3. Ask about travel history and group gatherings to help identify where the case became infected.
    4. If possible, record any restaurants at which the case ate, including food items(s) and date consumed.
    5. Ask about water exposures. If exposure is thought to be related to a swimming pool, wading pool, spray/splash pad, or spa exposure, the responsible environmental health agency should be notified (refer to the *Pool Inspection Contractor Contact List*) so that an

exposure risk assessment can be conducted and action can be taken to prevent further exposure at that site.
6. Ask about water supply because cryptosporidiosis may be acquired through water consumption.
7. Household/close contact, pet or other animal contact, child care, and food handler questions are designed to examine the case's risk of having acquired the illness from, or potential for transmitting it to, these contacts. Determine whether the case attends or works at a child care and/or is a food handler or has recently shown calves at a county fair.
8. Ask if the patient knows others who have similar illness about the same time.
9. If several attempts have been made to obtain case information, but have been unsuccessful (*e.g.*, the case or health care provider does not return calls or respond to a letter, or the case refuses to divulge information or is too ill to be interviewed), please enter as much information as has been gathered. Please enter into the Notes section the reason why any information could not be obtained. In IDSS, select the appropriate reason under the Event tab in the Event Exception field.

c. Iowa Administrative Code 641-1.3(139) stipulates that the laboratory and the healthcare provider must report. The preferred reporting method is through the Iowa Disease Surveillance System. The reporting phone number for IDPH Center for Acute Disease Epidemiology (CADE) is (800) 362-2736; fax number (515) 281-5698, mailing address:

IDPH, CADE
Lucas State Office Building, 5th Floor
321 E. 12th St.
Des Moines, IA 50319-0075

3) CONTROLLING FURTHER SPREAD

A. Isolation and Quarantine Requirements

In health care settings Standard Precautions should be used. Use Contact Precautions for diapered or incontinent persons for the duration of illness or to control institutional outbreaks.

B. Managing Special Situations

Child Care

Since cryptosporidiosis may be transmitted person-to-person through fecal-oral transmission, it is important to follow up on outbreaks of cryptosporidiosis in a child care setting. General recommendations include:

- Children with *Cryptosporidium* who have diarrhea should be excluded until their diarrhea is resolved. Children are not required to provide two negative stools to return to child care.

- Children with *Cryptosporidium* who have no diarrhea and are not otherwise ill may remain in the program if special precautions are taken. (Proper hand-washing practices, separation of diapering and food preparation areas, excluding if symptoms should occur.)

Schools

Since cryptosporidiosis may be transmitted person-to-person through fecal-oral transmission, it is important to follow up on suspected outbreaks of cryptosporidiosis in a school setting carefully. General recommendations include:

- Students or staff with *Cryptosporidium* who have diarrhea should be excluded until the diarrhea is resolved.

- Students or staff with *Cryptosporidium* who do not handle food, have mild or no diarrhea and are not otherwise sick may remain in school if special precautions are taken. (Proper hand-washing practices, separation of diapering and food preparation area, excluding if symptoms should occur.)

Food Handler

Note: A food handler is any person directly preparing or handling food, including a patient care or child care provider.

Since *Cryptosporidium* can be transmitted person-to-person through fecal-oral contact, it is important to carefully follow up on outbreaks of *Cryptosporidium* in any setting. General recommendations include:

- Food handlers with *Cryptosporidium* infection who have diarrhea should be excluded until 24 hours after last bout of diarrhea, or until stools are formed.
- Food handlers must practice frequent and thorough handwashing, using warm, running water, soap with friction for at least 15 seconds, and thoroughly drying hands with paper towels or a blow dryer.

Swimming Pools

In recent years, outbreaks from community swimming pools have become more frequent, especially in the summer months. The increased availability of shallow water for infants and toddlers (diaper-age children) may be a major reason for these outbreaks. Normal chlorination (1-8 ppm) will not destroy *Cryptosporidium* oocysts. All cases should be counseled not to swim for 2 weeks after resolution of diarrhea. This is due to the low infectious dose and hardy nature of *Cryptosporidium* oocysts, which are resistant to chlorine.

Signs should be posted prominently at all swimming venues directing that anyone who has a diarrheal illness should not use a public pool. Careful attention should be given to children in diapers so that "fecal accidents" do not contaminate a swimming or wading pool. Diaper-age children should always wear swim diapers to help prevent swimming pool water contamination by gross fecal material. Children in diapers should not have contact with public swimming or wading pool water if they have a diarrheal illness. Caregivers should not change diapers on the deck of a swimming pool; most newer facilities have diaper changing areas within the bathhouse. Dirty diapers should be disposed of in a sanitary fashion (never rinsed in pool water). Caregivers should thoroughly wash their hands and those of the child after changing a diaper.

Swimming pool inspections in most counties are done by a city, county or regional environmental health agency. If a sporadic case or an outbreak of *Cryptosporidium* occurs and is thought to be related to a swimming pool, wading pool, spray/splash pad, or spa exposure, the responsible environmental health agency should be notified (refer to the *Pool Inspection Contractor Contact List*) so that an exposure risk assessment can be conducted and action can be taken to prevent further exposure at that site. Include the number of suspect and confirmed cases linked to the implicated site and the date potential exposure began (12 days before symptom onset of earliest case) when notifying the environmental health agency.

If public health and environmental health officials recommend superchlorination (refer to the CDC Fecal Accident Response Recommendations) of a pool, the superchlorination should be done to minimize the time the pool facility is closed. Closing a facility to superchlorinate may move users to other facilities nearby. Public health and environmental health officials should consider a recommendation that nearby swimming facilities also superchlorinate as a precaution against further transmission of *Cryptosporidium*.

Community Residential Programs

Actions taken in response to an outbreak of cryptosporidiosis in community residential programs will depend on the type of program and the level of functioning of the residents.

In long-term care facilities, residents with cryptosporidiosis should be placed on standard precautions until symptoms subside. Contact Precautions should be used for diapered or incontinent persons for the duration of illness or to control institutional outbreaks. Staff members with *Cryptosporidium* infection should not work until diarrhea is gone.

In residential facilities for the developmentally disabled, staff and clients with cryptosporidiosis must refrain from handling or preparing food for other residents until diarrhea has subsided. Staff members with cryptosporidiosis who are not food handlers should not work until diarrhea is gone.

C. Reported Incidence Is Higher than Usual/ Community Outbreak Suspected

If the number of reported cases of cryptosporidiosis in your city or county is higher than usual, or if you suspect an outbreak, investigate to determine the source of infection and mode of transmission. A common vehicle (such as water, food, or association with a child care center) should be sought and applicable preventive or control measures should be instituted. Control of person-to-person transmission requires special emphasis on personal hygiene and sanitary disposal of feces. Consult with the CADE ((800) 362-2736) for assistance with investigation and control.

D. Preventive Measures

Personal Preventive Measures/Education

All cases regardless of whether or not they received treatment should be counseled not to swim for 2 weeks after resolution of diarrhea. This is due to the low infectious dose and hardy nature of *Cryptosporidium* oocysts, which are resistant to chlorine. Children in diapers should not have contact with public swimming or wading pool water if they have a diarrheal illness.

To avoid exposure, recommend that individuals:

- Always wash hands thoroughly with soap and water before handling food or eating, after using the toilet or changing diapers, and after contact with animals, especially cattle.
- Wash the child's hands and their own after changing diapers.
- Avoid drinking raw milk, other unpasteurized dairy products, or unpasteurized juices.
- Wash all raw fruits and vegetables before serving.
- Dispose of feces in a sanitary manner, especially in child care centers or other institutional settings.
- Avoid drinking water from streams or lakes. Avoid drinking unboiled water while traveling in developing countries or whenever water quality is unknown. (Bringing water to a full, rolling boil is sufficient to kill *Cryptosporidium,* or use filters capable of removing particles 0.1-1.0 micrometers in diameter.*)*
- Adhere to local advisories to boil water.
- Avoid swallowing water when swimming. Lakes, streams, other surface waters and swimming pools may be contaminated with *Cryptosporidium*. Chlorination does not effectively eliminate the parasite.

It is unlikely that *Cryptosporidium* could cause illness in regulated, public drinking water, but immunocompromised individuals may want to consider the following recommendations:

- Boil tap water before drinking or making ice cubes.
- Consider the use of a home water filtering system with a very fine filter (absolute pore size of 1 micron or smaller). Such filters include reverse-osmosis filters; filters labeled "absolute" 1 micron; and those labeled as meeting National Sanitation Foundation (NSF) standard #53 for cyst removal.

- Avoid fecal contact.
- Avoid sexual practices that may involve direct contact with feces. Latex barrier protection should be used to prevent the spread of *Cryptosporidium* and exposure to and transmission of other pathogens to case's sexual partners.

4) ADDITIONAL INFORMATION

The Council of State and Territorial Epidemiologists (CSTE) surveillance case definitions for Cryptosporidiosis can be found at: www.cdc.gov/osels/ph_surveillance/nndss/phs/infdis.htm#top

CSTE case definitions should not affect the investigation or reporting of a case that fulfills the criteria in this chapter. (CSTE case definitions are used by the state health department and the CDC to maintain uniform standards for national reporting.)

References

American Academy of Pediatrics. *2003 Red Book: Report of the Committee on Infectious Diseases, 26th Edition*. Illinois, American Academy of Pediatrics, 2003.
CDC website, Cryptosporidium Available at: www.cdc.gov/parasites/crypto/
Heymann, D.L., ed. *Control of Communicable Diseases Manual, 20th Edition.* Washington, DC, American Public Health Association, 2015.